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METHOD FOR MANUFACTURING WATERPROOF ZIPPER AND THE DEVICE MANUFACTURED FROM THE SAME

FIELD OF THE INVENTION

The present invention relates to waterproof zippers, and particularly to a method for manufacturing a waterproof zipper and the device made from the same.

BACKGROUND OF THE INVENTION

In the prior art of manufacturing slide fastener, it is found that the slide fastener can be immersed in repellant liquid so that mist will not be absorbed by stringer tapes easily. However, the result cannot be maintained for a longer time. When it is flushed by large amount of water, the stringer tapes always exposes in the steam, the waterproof effect will be reduced.

In Taiwan Patent Publication No. 094285, published on 16 Dec. 1987, "an impermaeable water proof slide fastener", applied by Japanese YKK CO., a flexible plastic membrane with the stringer tapes is heated and sealed for resisting water seepage. However, this prior art still needs improvement. It needs a C type slider to slide along the gripper elements to protect them from moisture. The bond tends to be detached from the stringer tapes due to long time abrasion. The adhesive of the bond between stringer tapes and membrane would have been diminished.

In Taiwan Patent Publication No. 126351, published on January 6, 1990. "waterproof zipper" applied by Japanese YKK Co. disclosed a prior art, where in manufacturing slide fasteners, water-abosoptive material Lanceal-F must be incorporated into nylon gripper elements. Then the nylon gripper elements with Lanceal-F is seamed on the stringer tapes.

This prior art needs more labors and costs than other ways of manufacturing.

In another Taiwan Patent Publication No. 503715, published on 21 Sep. 2002. "liquid impermeable slide fastener" applied by Jap. YKK Co., another prior art is disclosed. In this prior art, a special kind of slider instead of the popular coupling slider is used, but this special slider can not be matched with other sliders and thus can not be widely used.

Moreover, in U.S. Patent No. 6,105,214 patent, "water proof slide fastener and process for preparing same" assigned to Stuart Press. The characteristics of the invention is that a water resistant slide fastener, including a pair of stringer tapes each having first and second opposed surfaces and each having a series of gripper elements positioned along edges of said first surface; and a water resistant layer on said second surfaces, wherein said water resistant layer has an adhesion to said stringer tapes of at least about 6 lb/in. Thus, a combined multi-layer film adheres to the surface of stringer tapes. As they oriented outward to bear the abrasion or impact directly, they will be damaged. The water proof effect is reduced.

In US Patent No. 6,427,294 "water proof slide fastener and manufacturing method thereof" assigned to YKK Co, disclosed a multi-layer film laminated to the stringer tapes. To provide a waterproof slide fastener in which a synthetic resin film is fused to a fastener tape in order to prevent a perforation phenomenon that the synthetic resin film does not exist locally. A laminated synthetic resin film composed of low melting point resin layer having melting point of, for example, 100 degree C-140 degree C and high melting point resin layer having melting point of, for example, 150 degree C- 230 degree C is fused to a surface or both surfaces of a pair of the fastener tapes with the low melting point resin layer being in contact with and opposing the fastener tape by heating with

drying 24, and outputting 25.

As shown in Fig. 4, in the feeding stage 21, the nylon zipper 10 passes through a feeding device (formed by an upper and a lower rollers 32, 33) and is taken out from the feeding tank 31 so that the nylon zipper 10 is extended properly to be in flat state. The cross section view thereof is shown in Fig. 4A.

Next, a gluing step 22 is performed. In this step, the fastener strips 11, 12 are gluing so that the back sides of the fastener strips 11, 12 are coated with a layer of high adhesive gel. The main component of the glue is di-thermal liquid bridging polyester urethane resin (i. e., PU gel) mixed with bridging agent. The gluing device is made of a gel storage tank 34 with a gluing roller 35 therein. A pressing roller 36 with a rotation direction opposite to the gluing roller 35 is installed at one side of the nylon zipper 10 opposite to the gluing roller 35. When the gluing roller 35 is adhered with PU gel 37 in the gel storage tank 34, the pressing roller 36 presses the fastener strips 11, 12 so that the PU gel 37 is transferred to the back sides of the fastener strips 11, 12 and is combined to the polyester fibers. The cross sectional view of the gluing nylon zipper 10 is illustrated in Fig. 4B. The PU gel includes PU adhesive and solvent. If material of the fastener strips are different from the polyester fibers the PU gel can be replaced by other adhesives.

Next, a pressing step 23 is performed. When the fastener strips 11, 12 passes through the pressing rollers 38, 39, the PU gel is pressed into the polyester fibers of the fastener strips 11, 12. The capillary is helpful to the addition of the gel by pressing without increasing the thickness of the fastener strips 11, 12. Meanwhile, a good combining force is generated. At this time, the cross sectional view of the nylon zipper 10' is illustrated in Fig. 4C. Besides, the pressing rollers 38, 39 have further function of extending and smoothing the fastener strips 11, 12 with the guide rollers

41, 42 for drying.

In drying step 24, the fastener strips 11, 12 are heated in the heating box 40 so that solvent of the PU gel 37 vaporizes. The temperature of the drying box is about 120℃~180℃. The heating time is determined by temperature, for example, 12 second in 150℃.

Finally, the guiding step 25 is performed. In the guide device formed by the rollers 41, 42, when the active roller 41 rotates, the fastener strips 11, 12 will be driven so as to output the nylon zipper 10 coated with PU gel. Besides, the two rollers have the pull force for adjusting fastener strips 11, 12 and moving speed.

In above stage, the first stage can be repeated 1 to 3 times for increasing the coating and adhering effect between the PU gel 37 and the fastener strips 11, 12. This is related to the combining effect of the second stage to combine PU film to the PU gel 37.

With reference to Fig. 5, the block diagram of the second stage of the present invention is illustrated. Moreover, Fig. 6 shows the flow diagram of the second stage. From Fig. 5, it is shown that the stage includes the steps of feeding 26, adhering 27, heating and extruding 28, cutting 29 and guiding 30.

In above feeding step 26, the nylon zipper 10 coated with PU gel 37 are driven by two rollers 44, 45 and then are taken out from the feeding tank 43. The nylon zipper 10 is extended properly. The cross sectional view 6A is illustrated in Fig. 6A.

Next, the adhering step 27 is executed. A compound film formed by a release paper 50 and PU film 51 is wound on a winding roller 46. The width of the film is equal to that of the nylon zipper 10 coated with PU gel 37. When the compound film and nylon zipper are pressed by the rollers 47, 48, the PU film 51 is tightly adhered to the PU gel 37 at the backside of the fastener strips, as shown in Fig. 6B. Furthermore, the release

paper 50 of the film is separated from the PU film 51 behind the roller 47. Then the release paper 50 is guided out by another roller 49. Generally, the thickness of the PU film 51 is about 2 ~ 5 mil, which can be increased based on the manufacturing conditions. The PU film 51 is a single layer film. It is especially suited for batch production with a variety of types of different colors. Besides, the pigment can be added in the manufacturing of the film for getting the desired colors. If no pigment is added, agents for preventing discolor or yellowizing can be added for getting a transparent PU film. Moreover, anti-freeze agent, anti-acid agent, anti-alkali agent, anti-hardening agent, etc. can be added. Moreover, since the coarseness of the surface of the release paper is not uniform, when it is separated from the PU film 51, the inner surface of the PU film 51 may be coarse or smooth. If it is a coarse surface, the waterproof layer has a dim surface. If it is smooth, the waterproof layer is bright. In other words, a bright surface is transparent, and the dim surface is semi-transparent.

Then, the heating step 28 is executed. Mainly, the nylon zipper 10" with PU film 51 adhered thereto is transferred to a heating box 52 to be heated in a temperature of 120℃~200℃ through 12~17 seconds so that the PU film 51 is combined with the PU gel 37 by thermal plastics (referring to Fig. 6C). Since the PU film 51 and PU gel 37 are main components, after overheating, they will plasticize and then combine. Furthermore, a rear end of the heating box 52 may be installed with an extruding device formed by an upper press roller 54 and a lower press roller 53. The rollers presses the zipper 10 so that the backsides of the fastener strips 11, 12 are formed with waterproof layers 17, 18. Since the adhesion of the waterproof layers and the fastener strips 11, 12 are concrete, the two are firmly secured.

Next, the cutting stage 29 is performed. A thin knife 55 between the

two fastener strips 11, 12 cut the PU film 51 along the medial line thereof so that the original single sheet waterproof layer is cut into a left waterproof layer 17 and a right waterproof layer 18 (referring to Fig. 2A). The cutting depth can be determined by the thickness of the PU film 51. Since the waterproof layer is cut by the cutting knife, the general pull slider can be used.

Finally, a guide device formed by a set of upper and lower rollers 56 and 57 is use in the guide step 30. The roller 56 is a driving roller and the roller 57 is a driven roller. The driving roller 56 rotates to drive the fastener strips 11, 12 so as to output the nylon zipper 10 with waterproof layers 17 and 18 at the backside thereof. Besides, the two rollers 56, 57 have the function of adjusting the pull force and speed of the fastener strips. Furthermore, when a rear end of the heating box 52 is installed with two press rollers 53, 54, the rollers 56, 57 can be used to replace the two press rollers 53, 54 for pressing the PU film 51, PU gel 37 and the fastener strips 11, 12 so as to have an optimum combining effect.

Above mentioned is one preferred embodiment of the present invention for describing the present invention in detail, however, some modified embodiments within the spirit of the present invention can be used without confine the scope of the present invention. For example, in the first stage, the feeding step 21 and the gluing step 2 with a preheat step (not shown). Thereby, the unglued zipper 10' is preheated in temperature between 70℃ ~120℃. Thereby, the unglued nylon zipper 10' is more adhesion suitable to be adhered by the PU gel 37. In other words, heated unglued nylon zipper 10 has a preferred adhesion and coating effect to the PU gel 37.

Moreover, in the second step 22, other adhesive combinable to the PU film 51, such as base material polymer (polyester polyhydric alcohol or acrylic acid polyhydric alcohol) and micro inorganic stuff agent which is formed by bridging and hardening. Thereby, it is not confined to above

said PU gel 37.

Further, in second stage, the heating box 52 can be replaced by many sets of heating and pressing rollers necessary. Otherwise, a plurality of press rollers or a plurality of heating sections can be used in the present invention so that the PU film 51, PU gel 37 and fastener strips 11, 12 have an optimum combining effect.

SECOND EMBODIMENT

In this embodiment, the first and second manufacturing stages are integrated as a continuous manufacturing line, as shown in Figs. 7 and 8. The steps are feeding step 21, gluing step 22, pressing step 23, drying step 24, adhesion step 27, heating step 28, cutting step 29, guiding out step 30. In this embodiment, the guide device 25 in the first step and the feeding step 26 in the second stage can be reduced.

THIRD EMBODIMENT

To simplifying the manufacturing lines in Figs. 7 and 8, the block diagram in Fig. 9 can be performed. The stages includes the step of feeding step 21, gluing step 22, adhesion step 27, heating step 28, cutting step 29 and guiding out step 30, as shown in Fig. 10. In this embodiment, not only the manufacturing stage is simplified, but also a batch of small amount in manufacturing can be performed easily. From above description, it is known that the embodiments in Figs. 9 and 10 are most basic and simple manufacturing method in the present invention.

FOURTH EMBODIMENT

In above mentioned three manufacturing method, a printing step 221 or a press step 222 is added between the gluing step 22 and the adhesion step 23 (referring to Fig. 11). In the printing step 221, the inner surface of the

PU film 51 (not outer surface) is printed with beautiful pattern 512 (referring to Fig. 12) by screen printing. If it is presented by a perspective view, as shown in Fig. 2B, and practical view is illustrated in Fig. 16. In the press step 222, the convex or concave textures are printed on the inner surface (not outer surface) of the PU film 51 to form textures 511 (referring to Fig. 13). A perspective view is illustrated in Fig. 2C. In this embodiment, after the PU film 51 is combined with the PU gel 37, the patterns 512 or the texture 511 will not disappear out due to friction or scraping. Since the waterproof layer is transparent, the pattern or texture is clear and it can be identified easily. Moreover, the transparent texture 511 can be presented as protrusion texture.

In above Figs. 12, 13, it is found that for example, the waterproof layer 18 includes an inner layer 18a in the fastener strips 12 made of polyester fibers and an outer layer 18b at the outer side of the fastener strips 12. The thickness of the inner layer 18a is over 1/ 3 of the fastener strips, preferably, over 1/ 2.

The difference of the present invention with the manufacturing stage disclosed in USP 6,105,214 is that in the prior art, the glued waterproof film is transferred to the backside of the fastener strip of the zipper after the waterproof film is coated with gel, or after a low hardness film is transferred to the fastener strip, it is coated on the backside of the fastener strip. Whereas, in the present invention the PU film is first adhered to the backside of the fastener strip. Then by heating, the PU gel and PU film are combined as a waterproof layer by thermal plastic stage. Therefore, in the present invention, the physical properties, such as adhesion, heat-tolerance, etc. of the single layer waterproof layer are improved so that the waterproof layer can be generated with pattern or texture. This can not be achieved by the prior art.

Effect of the present invention will be described herein. In the

present invention, the PU gel is permeated into the fibers of the fastener strip so that the fastener strip is adhesive and has the function of waterproof. That is to say, when the outer PU film is destroyed by external force, the inner PU gel has the effect of waterproof. The PU gel and PU film are combined as a single film by thermal plastic stage and thus the manufacturing stage is simple and cost is low. The present invention can suit different climates or can be boiled in water and prevents from yellowizing and deformation. The solvent of the inner PU gel can vaporize completely so as not to harm the human body. The inner texture or pattern of the waterproof layer can prevent from scraping and have the function of counterfeit-proof.

COMPARISON OF THE PRESENT INVENTION WITH PRIOR ART

In the following, the present invention is compared with a waterproof zipper adhered by thermal melting gel.

As shown in Fig. 14, the waterproof zipper of the present invention (black) and the prior art waterproof zipper (white) are used as examples. In a temperature of 100 ℃ and boiling in water through 30 minutes, the waterproof layer of the waterproof zipper of the present invention is retained in a good condition and the waterproof layer of the prior art waterproof zipper scrapes.

Referring to Fig. 15, when the two waterproof zippers are sunk in organic solvent (ether) through 5 minutes. The waterproof layer of the waterproof zipper of the present invention is retained as the original condition, but the waterproof layer of the prior art has scraped.

Both in physical and chemical tests, the waterproof zipper of the present invention matches the requirement of international standard.

Determination of amines in dyestuff

As per Adidas-Salomon A-01 requirement with reference to German test procedure for detection of carcinogenic amine in dyed materials published in German official compilation of test and inspection procedures, extracted by citrate buffered solution pH 6 at 70℃ and detected by combination of gas chromatographic-mass spectrometric (GC-MS) and thin layer chromatographic (TLC) analysis. Based on German Texture method (B82.02-2 Jan 1998) and polyester method (B82.02-4 Jan 1998) Following amino material is tested:

4-Aminodiphenyl、

Benzidin、

4-Chlor-O-Toluidin、

2-Naphthylamin、

O-Aminoazotoluol、

2-Amino-4-Nitrotoluol、

P-Chloroanilin、2,4'-Diaminoanisol(4-Methoxy-M-Phenylenediamin)、

4,4'-Diaminodiphenylmethan、

3,3'-Dichlorobenzidin、

3,3'-Dimethoxybenzidin、

3,3'-Dimethylbenzidin、

3,3'-Dimethyl-4,4'Diaminodiphenylmethan、

P-Kresidin(2-Methoxy-5-Methylanilin)、

4,4'-Methylen-Bis-(2-Chloranilin)、

4,4'-Oxydianilin、

4,4'-Thiodianilin、

O-Toluidin、

2,4-Toluylendiamin、

2,4,5-Trimethylanilin、

O-Anisidine、

2,4-Xylidine、